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[Title of the Invention] POROUS SUBSTANCES

[Abstract]

[Object] To solve a problem in a porous substance of fluorine resin where creep deforming amount is big (cold flow is big).

[Constitution] A composition where fluorine resin is compounded with fibrous filler is molded into a predetermined shape.

[Claim]

[Claim 1]

A porous substance comprising a composition containing fluorine resin and fibrous filler as essential components and the rate of the fluorine resin to the total weight of the above

is 50 to 95% by volume.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a porous substance where fluorine resin is a main component.

[0002]

[Prior Art]

Fluorine resin has various excellent characteristics such as resistance to heat, resistance to chemicals, sliding characteristic and electric insulating property. A porous substance prepared by molding the fluorine resin into a predetermined shape is expected to have wide applications such as sealing material, packing, buffering material and filter utilizing the above-mentioned various characteristics and gas permeability.

[0003]

As to the porous substance of fluorine resin as such, there has been known a product such as, for example, that disclosed in the Gazette of Japanese Patent Laid-Open No. 61/066,730 which is prepared in such a manner that powder of polytetrafluoroethylene (hereinafter, it will be abbreviated as PTFE) is sintered and the resulting sintered powder is molded into a predetermined shape under a pressurized condition followed by heating/sintering at the temperature which is not

lower than the melting point of PTFE.

[0004]

[Problems that the Invention is to Solve]

However, in this porous substance of fluorine resin, there is a problem that deformation of creeps (cold flow) is big and that its use in the area where big load or big cramping force is applied is inadequate.

[0005]

[Means for Solving the Problems]

The present inventors have carried out various studies for solving the above-mentioned problems in the prior art and, as a result, they have found that, when a filler in a specific shape is compounded with fluorine resin, anti-creep property is able to be enhanced (amount of creep deformation is able to be reduced) whereupon the present invention has been achieved.

[0006]

Thus, the porous substance according to the present invention is characterized in that it comprises a composition containing fluorine resin and fibrous filler as essential components and the rate of the fluorine resin to the total weight of the above is 50 to 95% by volume.

[0007]

The porous substance according to the present invention is formed from a composition where fluorine resin and fibrous

filler are essential components. Compounding is carried out in such a manner that the rate of fluorine resin in the total weight of both of the components is made 50 to 95% by volume and that the rate of the fibrous fiber therein is made 5 to 50% by volume. When the compounding amount of the fibrous filler is out of the above range, no enhancement in the anti-creep property is noted and the aimed object is unable to be achieved whereby that is not preferred. As to the fluorine resin, PTFE is usually used although it is also possible to use one of a copolymer of ethylene with tetrafluoroethylene, a copolymer of tetrafluoroethylene with hexafluoroethylene, a copolymer of tetrafluoroethylene with perfluoroalkyl vinyl ether (hereinafter, it will be referred to as PFA) and polychlorotrifluoroethylene (hereinafter, it will be referred to as PCTFE) or a mixture thereof.

[0008]

The important thing in the present invention is that the fluorine resin and the filler are compounded in the above ratio and also that a fibrous one is used as said filler. With regard to the fibrous filler, that where diameter is about 5 to 50 μm and length is about 5 to 5,000 μm is preferred and it has been found to be particularly suitable to use a filler in which the value where the length is divided by diameter is about 20 to 200. Specific examples of the filler as such are an inorganic fiber such as carbon fiber, glass fiber and potassium

titanate fiber, an organic fiber such as aramid fiber and whiskers of silicon nitride, silicon carbide, etc.

[0009]

Although the porous substance of the present invention contains both fluorine resin and fibrous filler as essential components, other appropriate components such as filler particles, coloring agent or foaming agent may be further contained therein. It is also preferred for enhancing the close adhesion of the fluorine resin to the fibrous filler that the fluorine resin is subjected to a surficial treatment with a silane coupling agent or a titanate coupling agent.

[0010]

The porous substance according to the present invention may, for example, be prepared by a method mentioned in the above gazette of Japanese Patent Laid-Open No. 61/066,730. Porosity and average pore size of the porous substance prepared by said method may vary depending upon the manufacturing condition but, usually, the porosity is about 5 to 40% and the average pore size is about 5 to 50 μm.

[0011]

[Advantages of the Invention]

The present invention is constituted as mentioned above and fibrous filler is compounded with fluorine resin. Accordingly, as will be apparent from the following Examples, anti-creep property of the fluorine resin porous substance is

now able to be enhanced.

[0012]

[Examples]

The present invention will be further illustrated by way of the following Examples.

Example 1

Commercially available sintered PTFE powder (average particle size: 100 μm) (80% by volume) was compounded with 20% by volume of glass fiber (diameter: 10 μm; length: 100 μm) followed by uniformly mixing using a Henshel mixer.

[0013]

The resulting mixed composition was filled in a cylindrical metal mold and molded by pressurizing at 200 kg/cm^2 for 5 minutes at room temperature (about 25°C) and the molded product was taken out from the metal mold. Then this molded product was sintered by heating at 370°C for 3 hours to give a column-shaped porous substance. Porosity of this porous substance was 20% and average pore size thereof was 20 μm.

[0014]

A creep deforming rate of said porous substance was measured and found to be 5.3%. The creep deforming rate was measured as follows. Thus, a cylindrical sample where outer diameter was 25.6 mm, inner diameter was 20 mm and height was 20 mm was prepared, then applied with a load of 20 kg/cm^2 and allowed to stand at 250°C for 24 hours, height (L_1) of said sample

before being allowed to stand and height (L_2) thereof after being allowed to stand were measured, L_2 was deducted from L_1 to determine the change in the height (S) and said S was divided by L_1 followed by multiplying by 100 whereupon the creep deforming rate was calculated.

[0015]

Comparative Example 1

The same operation as in Example 1 was carried out except that no glass fiber was used to give a porous substance where porosity was 5% and average pore size was 4 μm. A creep deforming rate of this porous substance was 11.5%.

[0016]

Comparative Example 2

The same operation as in Example 1 was carried out except that 2% by volume of glass fiber was compounded with 98% by volume of sintered PTFE powder to give a porous substance where porosity was 6% and average pore size was 5 μm. A creep deforming rate of this porous substance was 11.2%.

[0017]

Comparative Example 3

The same operation as in Example 1 was carried out except that 50% by volume of glass fiber was compounded with 50% by volume of PTFE powder to give a porous substance where porosity was 40% and average pore size was 55 μm. A creep deforming rate of this porous substance was 10.4%.

[0018]

Example 2

The same operation as in Example 1 was carried out except that 45% by volume of carbon fiber where diameter was 7 μm and length was 200 μm was compounded with 55% by volume of sintered PTFE powder to give a porous substance where porosity was 35% and average pore size was 45 μm. A creep deforming rate of this porous substance was 7.8%.

[0019]

Example 3

The same operation as in Example 1 was carried out except that 5% by volume of aramid fiber (aromatic polyamide fiber) where diameter was 7 μm and length was 500 μm was compounded with 95% by volume of sintered PTFE powder to give a porous substance where porosity was 7% and average pore size was 10 μm. A creep deforming rate of this porous substance was 8.3%.

[0020]

Example 4

The same operation as in Example 1 was carried out except that 20% by volume of potassium titanate fiber where diameter was 7 μm and length was 50 μm was compounded with 80% by volume of non-sintered PFA powder to give a porous substance where porosity was 18% and average pore size was 22 μm. A creep deforming rate of this porous substance was 4.7%.

[0021]

Example 5

The same operation as in Example 1 was carried out except that 20% by volume of silicon carbide whisker where diameter was 5 μm and length was 50 μm was compounded with 80% by volume of non-sintered PCTFE powder to give a porous substance where porosity was 15% and average pore size was 17 μm. A creep deforming rate of this porous substance was 4.4%.